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ABSTRACT

This slide script, part of a series of slide scripts designed for use in vocational agriculture classes, deals with approved practices in dairy reproduction. Included in the guide are narrations for use with 200 slides dealing with the following topics: the importance of good reproduction, the male and female roles in reproduction, selection of parents for reproduction, management of heifers for good reproduction, procedures for timing insemination for successful conception, heat detection practices, conception and growth of the embryo, nutrition and reproduction, dry cows, techniques for calving and caring for newborns, and procedures for timing rebreeding. (MN)

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Approved Practices in Dairy Reproduction

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Slide Script

Roger D. Roediger

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FOREWORD

Nature and Purpose of the Series

Level of milk production and the amount of profit or loss from dairy cattle are closely tied to the reproductive practices followed with the herd. It is the purpose of this series to illustrate those practices which are likely to improve milk production and increase chances for profit. The practices included in this series are referred to as **approved practices** because research and practical application over time have shown them to be reliable and useful in improving reproductive results.

Suggestions for Use

1. Review the slide series and select those frames that are appropriate for use in preparing a specific lesson.
2. Plan related learning activities that will precede and give importance to the use of the slides.
3. Study the script before class presentation. In your study find the major teaching point the author suggests can be illustrated by each frame. Then prepare to present your own comments in your own way that best fits your teaching style and the teaching situation at hand. Avoid reading the script to the class. (Script reading by the student may be appropriate when used as student self-study for make up or review activity.)
4. Plan follow-up activity that gives students opportunity to practice or reinforce lessons illustrated by the slides.

James E. Cummins, Director
Agricultural Education Service
State Department of Education

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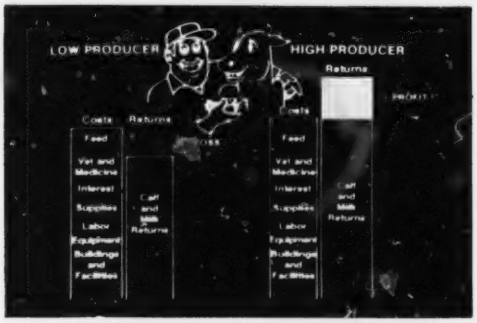
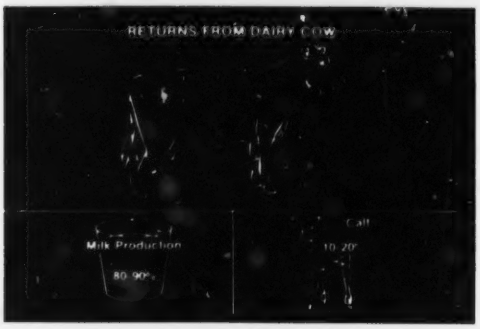
APPROVED PRACTICES IN DAIRY CATTLE REPRODUCTION

IMPORTANCE OF GOOD REPRODUCTION

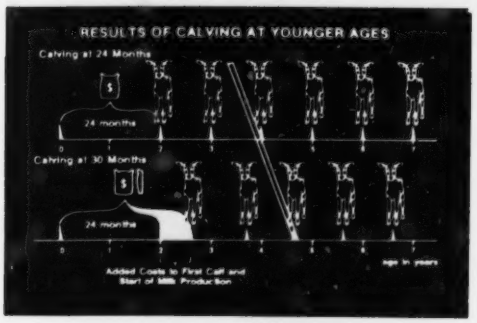


Profit Depends upon Good Reproduction

1. In order to make a profit in dairying, dairy farmers must be able to keep their cows' milk production high. All cows in a herd have similar "room and board costs" which must be paid. A profit is possible only from those cows which produce more than enough milk to pay all room and board costs.

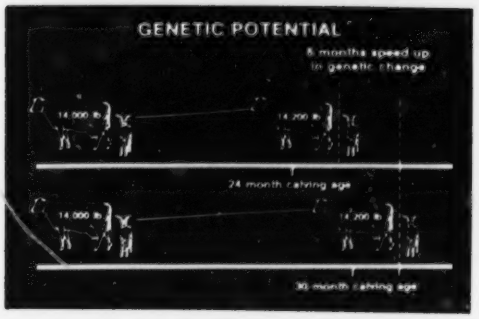


2. While most of the direct returns in dairying come from the sale of milk, the calving program is no less important to profits. High milk production is very dependent upon good reproduction.

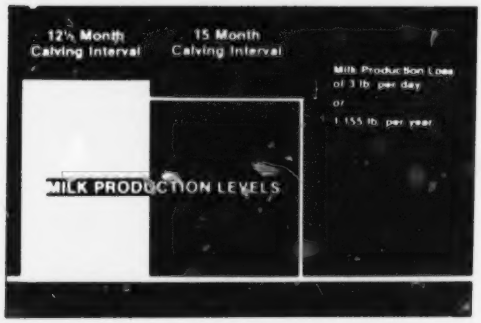

RESULTS OF CALVING AT YOUNGER AGES
Calving at 24 Months
24 months
Calving at 30 Months
24 months
Added Costs to First Calf and Start of Milk Production
age in years

Calving Heifers at Younger Ages

3. One reproductive practice that increases the amount of milk per animal in the herd (including replacement heifers) is calving of heifers at younger ages. This gets heifers in milk sooner, making a "pay back" on their room and board costs. Younger calving requires good nutrition and the use of good breeding practices.

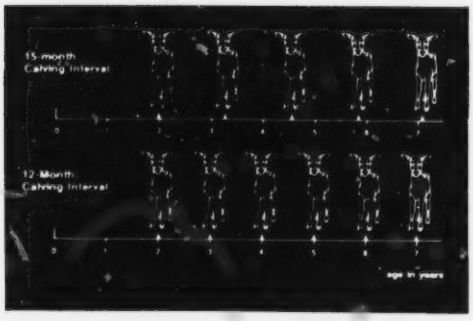


4. Calving at younger ages also increases the speed at which genetic improvement can be made. New generations with potentially higher levels of milk production are available more often.

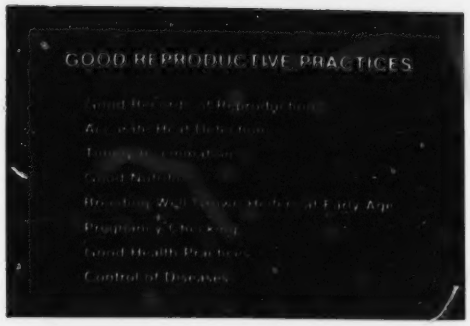


Shorter Calving Intervals

5. Once the heifer reaches calving age, she is most likely to produce more milk per day in the herd by having short calving intervals (period of time from one calving to the next) of 12 to 12½ months. Calving intervals longer than 13 months will lower milk production significantly.



6. Longer calving intervals also result in fewer calves born each year. For each month the calving interval goes over 12 months, the number of calves born in the herd each year is reduced about 8%. This results in fewer heifers available for herd replacements.



Good Production Depends upon Good Reproductive Practices

7. High milk production is very dependent upon good reproductive practices — practices such as getting heifers to calve early and maintaining cows on short calving intervals. But these reproductive results don't just happen. They result from commitment by the producer to apply the **best** approved reproductive practices and those health and nutrition practices related to reproduction:

   - Good records of reproduction
   - Accurate heat detection
   - Timely insemination
   - Good nutrition
   - Breeding well-grown heifers at early age
   - Pregnancy checking
   - Good health practices
   - Control of diseases

THE MALE'S ROLE IN REPRODUCTION

Parts of the Reproductive System

8. The parts of the reproductive system of the bull and their functions are:

   Testes (singular, testis) (or **testicles**) - primary sex glands where sperm are formed and male hormone (testosterone) is produced.

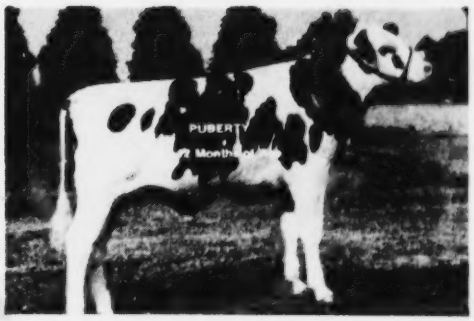
   Scrotum - part of the skin which suspends the testes outside the body cavity and helps regulate the temperature within the testes.

   Epididymis - large duct on the side of the testis which collects and stores sperm during maturation.

   Vas deferens - duct which carries sperm from the epididymis to the area of the accessory sex glands.

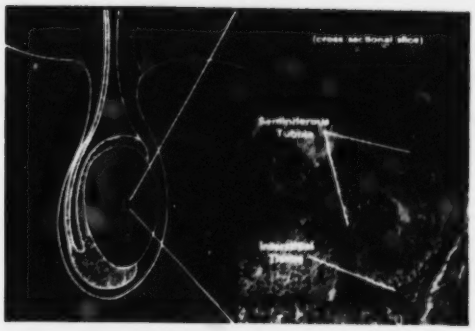
   Accessory sex glands (include the **seminal vesicles, Cowper's glands,** and **prostate gland**) - add nutrients, protective and transportation fluids to sperm, forming semen.

   Penis - organ used in mating to place semen in the reproductive system.



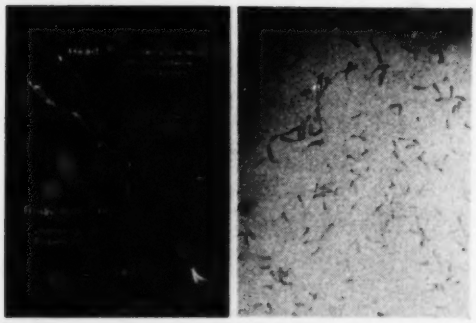
Sperm Production

9. Bull calves normally reach puberty and the production of the sex cells, **sperm**, at 8 to 12 months of age.

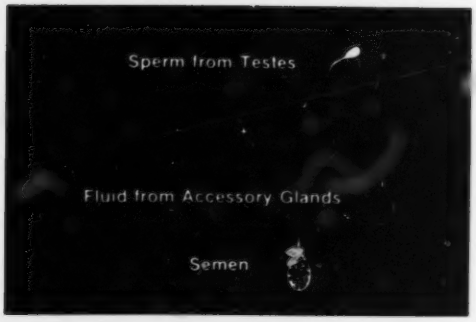


10. The sperm are produced within the **testicles** in tubules referred to as **seminiferous tubules**. The male sex hormone **testosterone** is also produced within the testicles in the tissue between the tubules called **interstitial tissue**.

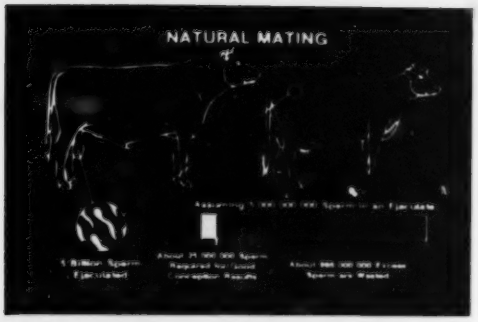
11. This is a view of a testicle without the **scrotum**. The **epididymis** and **vas deferens** can be seen. The major part of the testicle is made up of a mass of seminiferous tubules (about 15,000 feet in total length), where the sperm cells originate.



12. Once a bull reaches puberty, he continuously produces sperm unless disease, injury or other environmental problems cause him to become infertile. He will produce approximately 7 billion sperm each day, 70% or about 5 billion of which are alive and fertile.



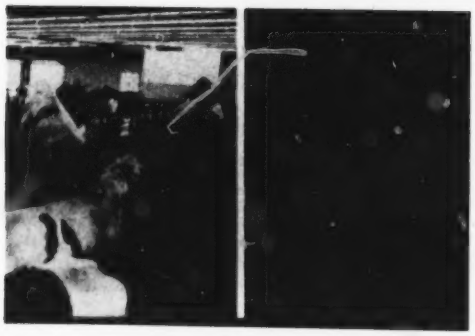
13. At the time of release (ejaculation) the sperm are mixed with fluids from the **accessory glands** to form the semen. The fluids in the semen provide the right environment for fertile sperm.



Making Better Use of Sperm Production

14. In natural mating the bull would service one or, at the most, several cows in one day. Approximately 5 billion sperm are ejaculated, but only about 25 million are necessary for the one sperm to achieve conception in each fertile cow. A very large proportion of the sperm ejaculated is wasted in natural mating.

15. If all 5 billion sperm produced by a bull in one ejaculation were harvested and divided into groups of 25 million each, there would be enough sperm for inseminating 200 cows.

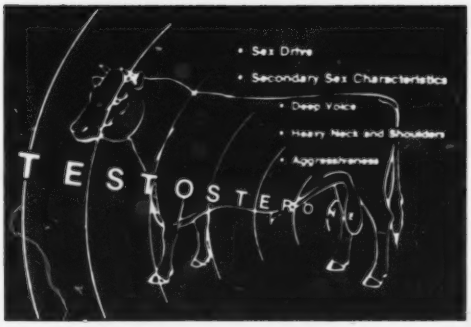


Sperm Collection

16. Harvesting the sperm is accomplished by collecting the semen ejaculated into an artificial vagina with a collecting tube attached.

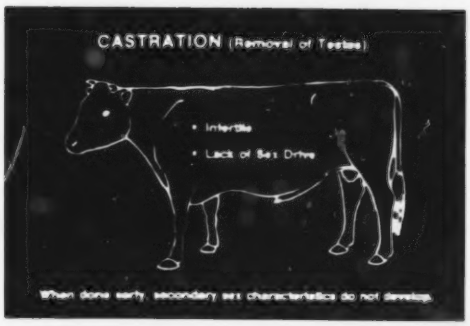
17. The semen is tested for quality, processed, and divided into amounts adequate for single inseminations.

18. Then the individual "straws" are put into liquid nitrogen storage which is at -196° C. Sperm remain alive and capable of fertilization for years when kept at this temperature. Thus semen can be stored until needed for insemination.



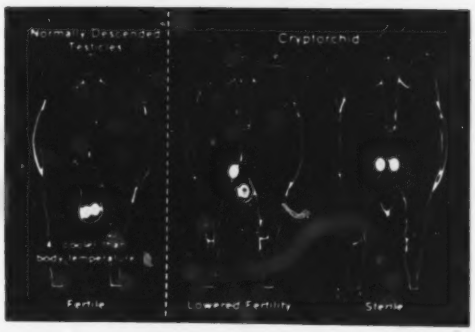
Male Hormone — Testosterone

19. The male hormone **testosterone** from the testes circulates through the blood system. As the bull develops, the hormone promotes the male sex drive. Testosterone also promotes the development of the secondary sex characteristics: — the heavy muscling, especially around the neck and shoulders, a deeper voice, and an aggressive nature.


CASTRATION (Removal of Testes)
• Infertile
• Lack of Sex Drive
When done early, secondary sex characteristics do not develop.

Effects of Removing Testicles

20. If the bull calf is castrated (testes removed) at an early age, the source of testosterone is removed. The animal will not develop the secondary male characteristics of heavy muscling around the neck and shoulders, the deeper voice, and an aggressive nature. As the animal reaches the age of sexual maturity, it will lack sex drive. It will be unable to produce sperm because the source of testosterone and sperm production— the testicles— has been removed.



Effects of Undescended Testicles

21. Some bulls develop with one or both testicles remaining in the body cavity rather than descending normally into the scrotum. Known as **cryptorchids**, these bulls are sterile if both testicles are retained, or with much reduced sperm production if one is retained. Sperm do not develop properly at the higher temperature of the body cavity.

22. Testosterone production is not affected in a cryptorchid bull. At maturity the bull can have normal sex drive and all the secondary male characteristics such as heavy neck and shoulders, deep voice, and aggressiveness. However, if both testicles are up in the body cavity, the bull will be sterile.

THE FEMALE'S ROLE IN REPRODUCTION

Parts of the Reproductive System

23. The parts of the reproductive system of the cow and their functions are:

Ovary - primary reproductive organ which produces eggs (female reproductive cells) and two hormones, estrogen and progesterone.

Infundibulum - funnel-shaped end of the oviduct which aids in collecting the eggs as they are released from the ovaries.

Oviduct - tube which carries the egg to the uterus; site of fertilization.

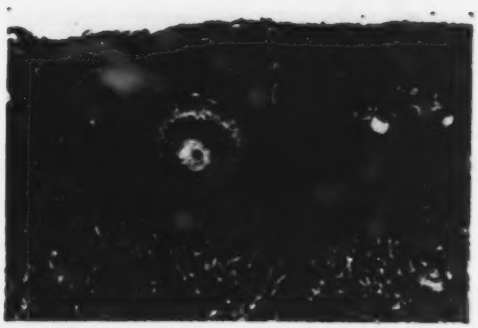
Uterus (Womb) - the organ in which the embryo develops and is nourished until birth. In cattle the uterus is separated into two rather long horns; the embryo develops in one or the other.

Cervix - a muscle which serves as a neck of the uterus, closing it off from the vagina.

Vagina - the passageway (birth canal) from the uterus to the external opening of the reproductive tract. Also the site where semen is deposited during mating.

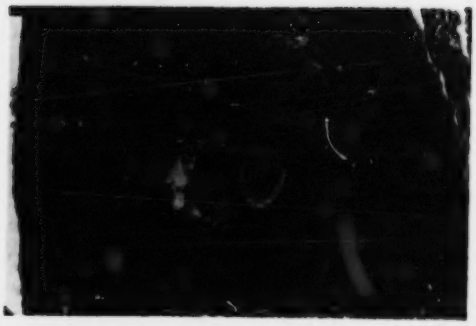
Vulva - the external opening of the vagina and the external genital parts.

24. Each of the cow's two ovaries is an oval- to bean-shaped organ 1 to 1½ inches long.

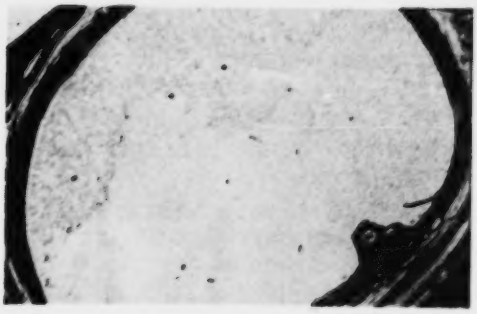


Egg Production and Ovulation

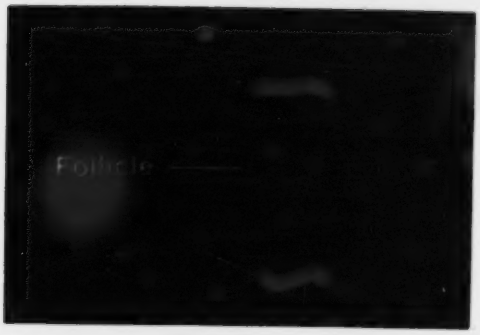
25. The cow's **ovary** produces **eggs**, usually one maturing at a time, in cycles, rather than the continuous manner in which sperm are produced in the bull. Each egg begins as a germ cell surrounded by a layer of cells called a **primary follicle.**



26. As a follicle develops, many layers of cells are added to the single layer surrounding the eggs, and a central cavity forms.



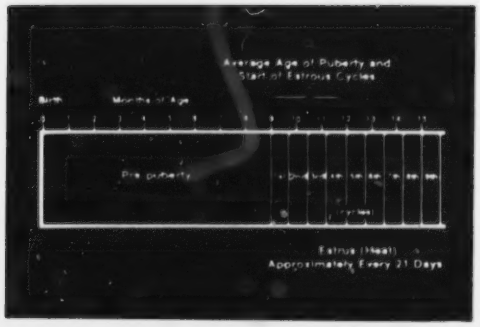
27. As the follicle and cavity grow larger, the egg is attached by a stalk of cells to the back side of the follicle opposite the site of ovulation.



28. As the follicle continues to grow rapidly, the side opposite the egg bulges from the surface of the ovary and becomes very thin and blister-like. The thin portion ruptures at ovulation and releases the contents of the follicle including the egg.

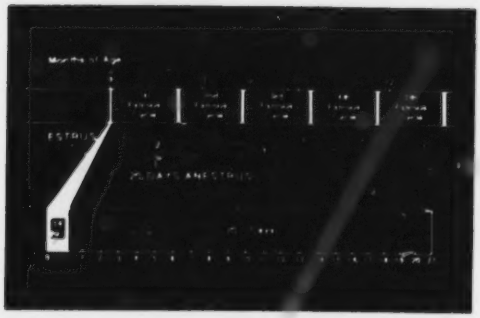
Age of Puberty and Beginning of Estrous Cycles

29. Heifers reach puberty (become sexually mature) and begin ovulating at about 9 to 12 months of age.



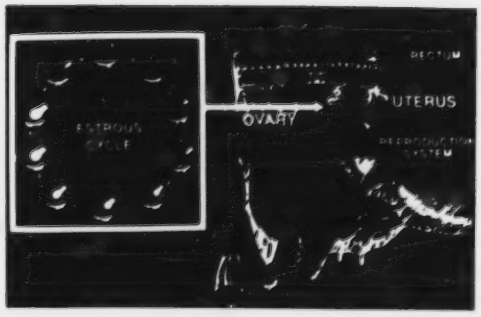
Events in the Estrous Cycle

30. At puberty heifers show the first signs of **estrus** (or **heat** - a period of being receptive to mating). The heat periods recur in cycles (**estrous cycles**) every 18 to 24 days (average 21 days).



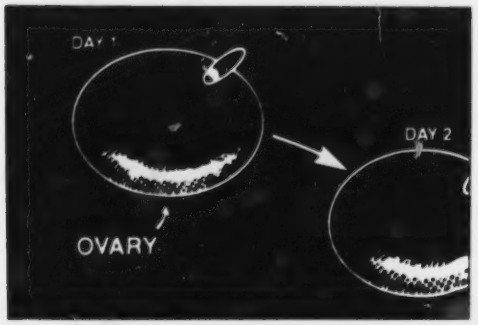
31. The heat period at the start of each estrous cycle normally lasts about 14 hours, but it can vary from 4 to 40 hours. During the other approximately 20 days of each cycle (the anestrous period) the cow is not receptive to mating.

32. Ovulation does not occur during heat but approximately 10 to 16 hours after the cow goes out of heat.

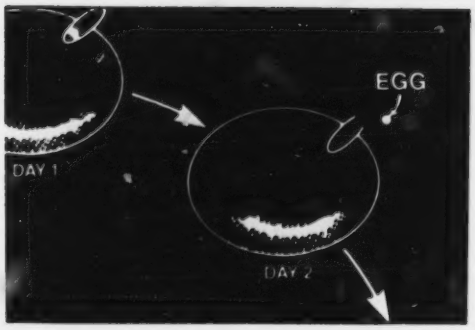


Influence of Female Hormones

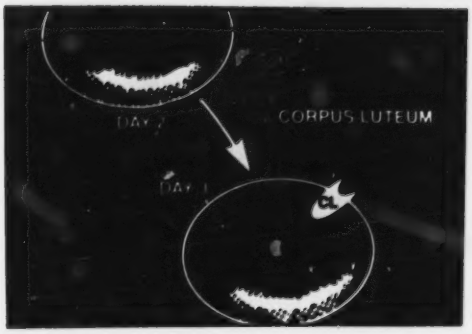
33. Normal reproduction in the female depends upon hormones, two of which are **estrogen** and **progesterone** produced in the ovaries. It is the cycle of hormone production which determines the signs of heat and causes ovulation.



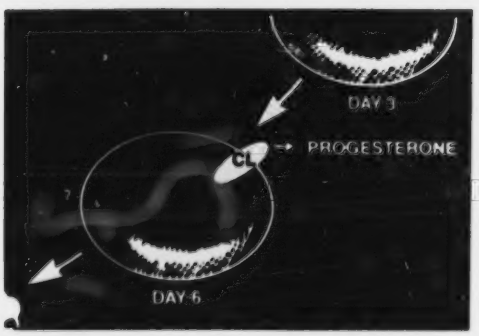
34. On *day 1* of heat, the cow has a blister-like follicle on one ovary. Inside this follicle is a mature egg. At this stage the follicle produces a high level of estrogen which causes the cow to display the signs of heat.



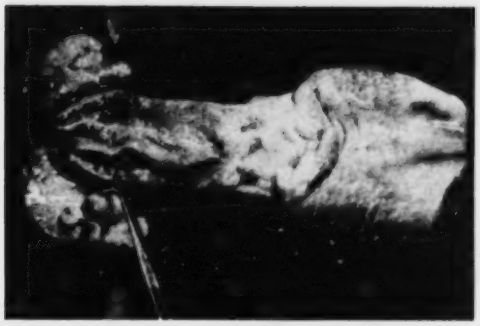
35. On *day 2* the follicle ruptures. The egg is released and estrogen production stops.



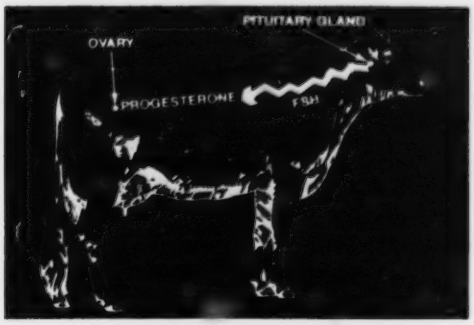
36. Cells begin to grow in the void of the ruptured follicle, building a structure called a corpus luteum (CL). Because of its dark yellow color, it is also called "yellow body."



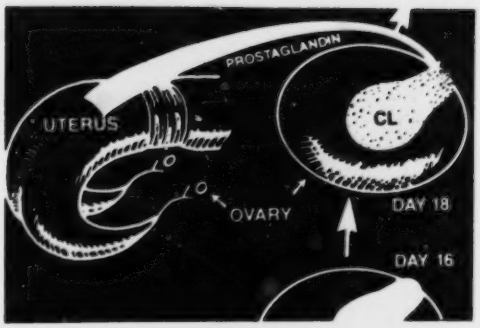
37. The corpus luteum produces the hormone progesterone.



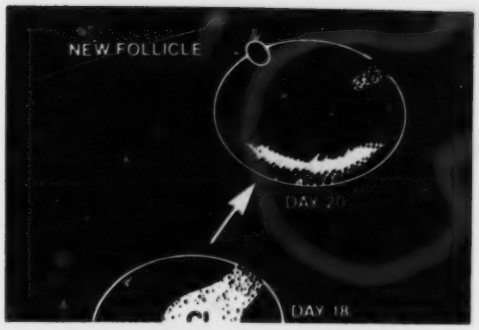
38. One function of progesterone is to prepare the uterus for pregnancy by reducing uterine movements and promoting nurturing secretions.



39. Another function of progesterone is to block the release of the follicle stimulating hormone (FSH). If FSH were *not* blocked, the ovary would be stimulated to develop another follicle immediately.

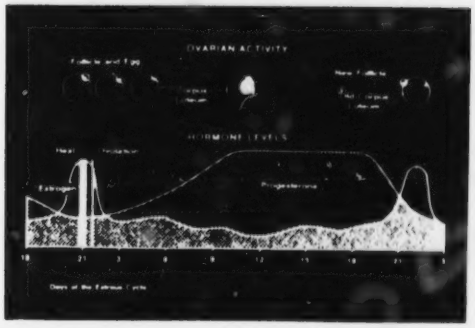


40. If the animal is not pregnant, on about *day 17 or 18* the uterus begins to produce the chemical prostaglandin. Prostaglandin dissolves the corpus luteum.



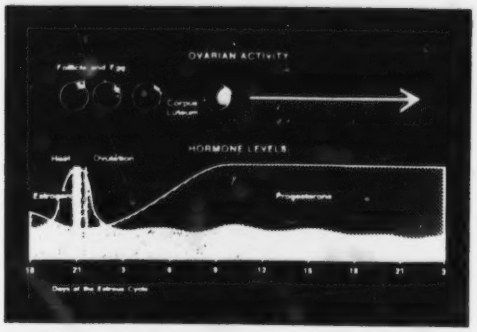
41. With the corpus luteum gone, there is no progesterone to block the release of FSH, the hormone which stimulates follicle development. As a result a new follicle begins to develop at another site on one of the ovaries.

42. In a 21-day period, one normal estrous cycle is completed.



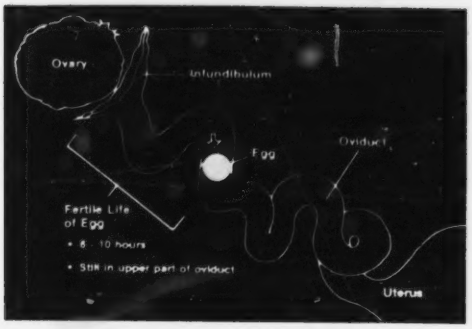
Hormone Levels — Ovarian Activity — *NO PREGNANCY*

43. This graphic gives the summary of ovarian activity and hormone levels, with **no pregnancy**, through an estrous cycle as described in slides 33-42.



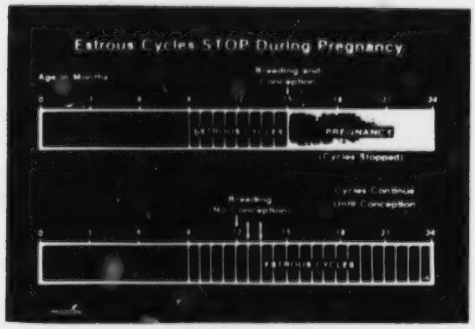
Hormone Levels - Ovarian Activity — *PREGNANCY*

44. If pregnancy occurs, the corpus luteum remains and continues to produce progesterone. This blocks the action of the follicle stimulating hormone so that no follicles develop to maturity during pregnancy.



Travels of the Egg after Ovulation

45. After ovulation the egg enters the oviduct and begins traveling to the uterus. The egg remains fertile for only about 6 to 10 hours after ovulation. During this time it usually has traveled no further than the upper third of the oviduct.

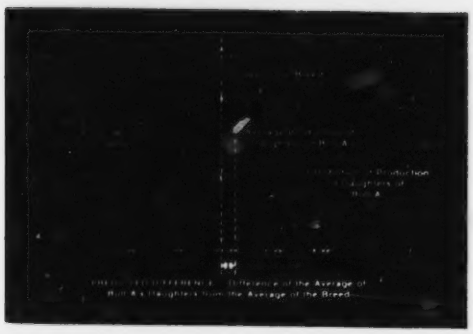


46. If the egg is fertilized and the heifer becomes pregnant, the estrous cycle stops until the pregnancy is over. If the heifer does not become pregnant, she will continue cycling.

SELECTING PARENTS FOR REPRODUCTION

"Top" Animal Selection — Bulls

47. Since nearly all heifers are needed for herd replacements, there is very little opportunity to select heifers from only the outstanding cows. By contrast, with the use of artificial insemination (AI), very few bulls are needed for breeding. It is possible to be very selective and use only those bulls from very outstanding cows.



Use of Predicted Difference with Bulls

48. Extensive progeny tests are a large part of bulls' becoming "proven sires." A very useful part of the sires' "proof" is calculated **predicted difference (PD).** A bull's PD is the amount that the average of a bull's daughters is above or below the breed's average for selected characteristics such as milk production.*

* Technically the average is based on the daughters of sires at a given time and will differ slightly from the breed average.

TOP AI SIRES RANKED ON PREDICTED DIFFERENCE DOLLARS

		PRODUCTION			TYPE	
Names	% Rept.	PD Milk	PD %	PD $	% Rept.	PD Type
Cor-Vel Enchantment	73	+1770	-0.03	+213	70	+0.43
Lemax Pawnee Memorial	69	+1338	+0.03	+178	63	+1.27
Rockalli Son of Bova	95	+1792	-0.15	+175	89	+1.76
Cal-Clark Board Chairman	82	+1502	-0.06	+170	82	+1.83
Leadfield Columbus-ET	83	+1492	-0.06	+169	65	+1.05
S-W-D Valiant	99	+1274	+0.03	+169	99	+2.14
Maize Valley Chief Starlite	45	+1757	-0.17	+166	44	+0.76
Air-Osa Oak Quick Shot	50	+1595	-0.11	+166	36	+1.28
Moodys Pat Troy	78	+1047	+0.10	+163	46	-0.71
EZ Acres Starlite Bachelor	72	+1044	+0.10	+163	—	—
Scenic-View Chief Apollo J	45	+515	+0.32	+163	51	+0.74
Sweet-Haven Tradition	97	+1655	-0.14	+161	94	+1.71
Holler-View Elevation Marc	56	+1184	+0.02	+156	60	+0.87
Fivebrooks Starfire	79	+1411	-0.07	+155	82	-0.14

49. *Predicted difference* values are calculated for a number of cow characteristics including: 1) milk production, 2) percent butter fat, 3) pounds of butterfat, 4) dollars of product produced, and 5) physical type. **The best index of profitability is *predicted difference* for dollars of product produced.**

TOP AI SIRES RANKED ON PREDICTED DIFFERENCE DOLLARS

Names	PRODUCTION % Rept.	PD Milk	PD %	PD $	TYPE % Rept.	PD Type
Cor-Vel Enchantment	73	+1770	-0.03	+213	70	+0.43
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Cal-Clark Board Chairman	82	+1502	-0.06	+170	82	+1.83
Leadfield Columbus-ET	63	+1492	-0.06	+169	65	+1.05
S-W-D Valiant	99	+1274	+0.03	+169	99	+2.14
Maize Valley Chief Starlite	45	+1757	-0.17	+166	44	+0.76
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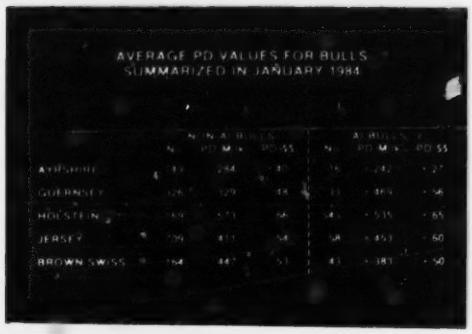
Scenic-View Chief Apollo J	45	+515	+0.32	+163	51	+0.74
Sweet-Haven Tradition	97	+1855	-0.14	+161	94	+1.71
Holler-View Elevation Marc	56	+1184	+0.02	+156	60	+0.87
Firebrooks Starfire	79	+1411	-0.07	+155	82	-0.14

50. **Repeatability (% Rept.)** measures the accuracy of the *predicted difference*. The closer *repeatability* is to 100, the more reliable the *predicted difference*.



Better Predicted Difference from AI Bulls

51. Bulls proven by AI use have achieved a much better *predicted difference* than those proven by non-AI. In all breeds there are nearly 1,000 more pounds of milk production from AI than from non-AI bulls.

NAAB CALVING EASE SUMMARY - JANUARY 1984

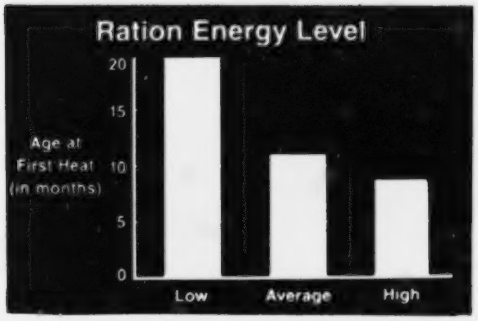
Code	Sire	Number of Comparisons	% Probability of Being Easier Than Breed Average	Expected % of Difficult 1st Births
7H598	Free Lancer	192	94	6
7H992	Index	29	83	6
7H905	Gem	240	90	7
7H448	High Spot	1484	99	7
7H903	Money Maker	925	99	7
7H715	Super	262	89	7
7H241	Cinnamon	4778	99	7
7H1124	Majestic	103	78	8
7H803	Pinto	26	70	8
7H879	Milford	25	69	8

52. For use on heifers, selection should be made of an AI bull which also has a good rating for calving ease.

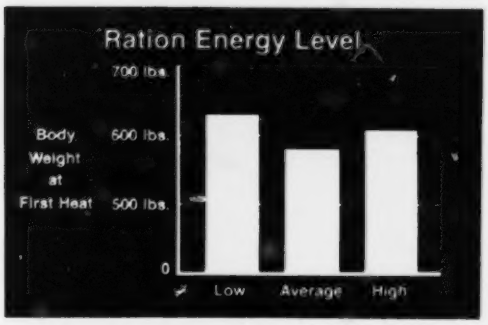
MANAGING HEIFERS FOR GOOD REPRODUCTION

Adequate Nutrition and Heifers' Calving Age and Weight

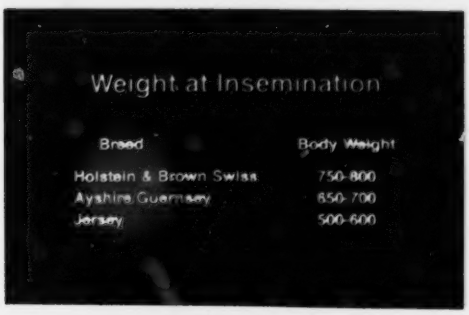
53. In order to have heifers calve at 24 months of age, breeding should be done at 14 to 15 months. Heifers should be big enough by 14 months so that cycling and calving problems will be held to a minimum. This requires top management and a well-balanced nutritional program.



54. Cornell researchers fed Holstein heifers rations at three different levels of energy during the first two years of life. Heifers came into heat at about 11 months of age when they received 100% of the daily minimum energy requirements. Those receiving 62% of daily minimum energy requirements came into heat at 20 months. Those receiving 146% of the daily requirements had first heat as early as 9 months.

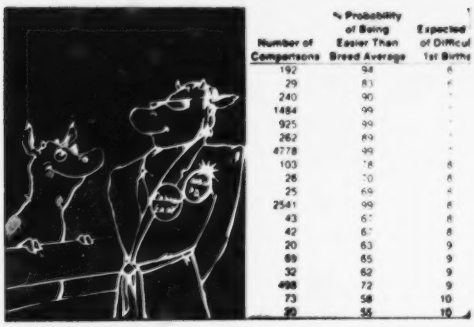


55. All three groups had similar average body weights at first heat. The results indicate that ration energy level and body weight are more important than age in determining when heifers reach first heat.



56. Dairy heifers should be bred when they reach these body weights - normally by 14 to 16 months of age.

57. A good way to check the adequacy of heifer rations is to measure the growth rate of heifers periodically with a heart girth tape.



Number of Comparisons	% Probability of Being Easier Than Breed Average	Expected of Difficul 1st Births
192	94	6
29	83	6
240	90	-
1484	99	-
925	99	-
262	89	-
4778	99	-
103	78	8
26	70	8
25	69	8
2541	99	8
43	67	8
42	67	8
20	63	9
69	65	9
32	62	9
498	72	9
73	58	10
20	55	10

Use of Bulls Rated Good for Calving Ease

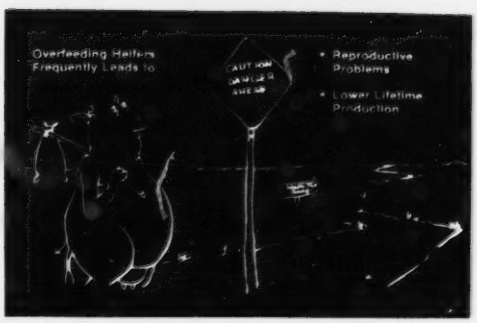
58. Even with good nutrition and growth heifers have more calving difficulties with the first calf than they do with later calvings. Dairy heifers should be bred by artificial insemination to bulls with both a high **predicted difference** for milk and a good calving ease rating.

Reproductive Problems

59. About 1 of every 10 heifers never enters the milking herd because of reproductive problems. Early detection and removal of these problem animals saves the rearing cost of non-breeders.

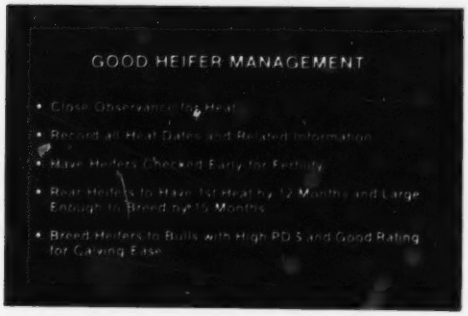
Free-martins

60. About 90% of the heifers born twin to bulls are sterile. These heifers, known as **free-martins**, have organs with varying abnormalities that sometimes can be detected by a veterinary examination. Blood typing can detect free-martins with near-100% accuracy.



Results of Overfeeding

61. Overfed heifers frequently have conception problems. They also have poorer reproductive performance in the first and later lactations, and a lower lifetime production of milk.



Good Management Checklist

62. Good heifer management includes:

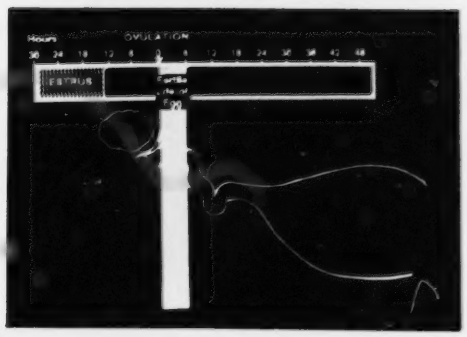
    1. Watching heifers closely for heat.
    2. Recording all heat dates and related information.
    3. Checking heifers early for fertility; culling sterile animals to save their rearing costs.
    4. Rearing heifers to have first heat by 12 months and to be large enough to breed by 15 months.
    5. Breeding heifers to bulls with high PD $ and good rating for calving ease.

TIMING INSEMINATION FOR SUCCESSFUL CONCEPTION

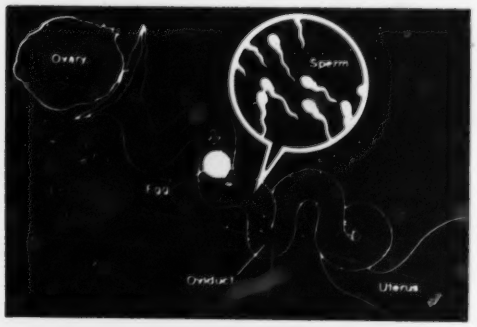
Matching Fertile Life of Egg and Sperm

63. If cows are inseminated at the proper time, the mature egg will be quickly surrounded by sperm cells, increasing the possibility of fertilization and pregnancy.

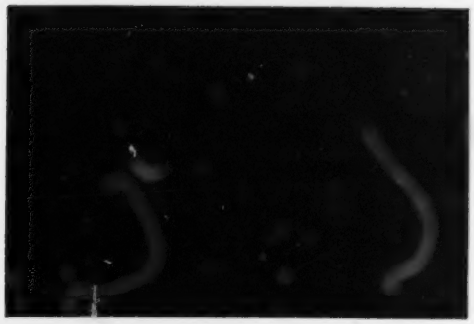
64. The success of getting cows pregnant depends upon the ability of the producer to time insemination so that viable sperm and egg meet.



65. There are only about 6 to 10 hours during each 21-day estrous cycle when the cow is fertile. These are the 6 to 10 hours following ovulation. During these hours, the egg is in the upper portion of the oviduct.

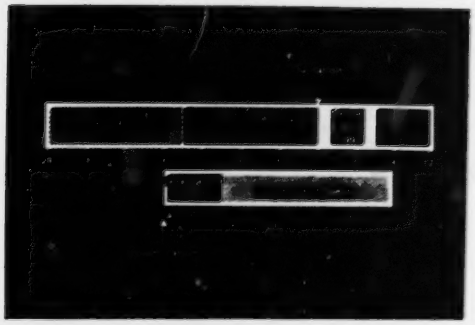


66. For conception to occur, fertile sperm must be in the upper portion of the oviduct at ovulation. Since sperm must be in the female tract about 6 hours before they acquire the ability to fertilize the egg, the cow should be inseminated *before ovulation.*

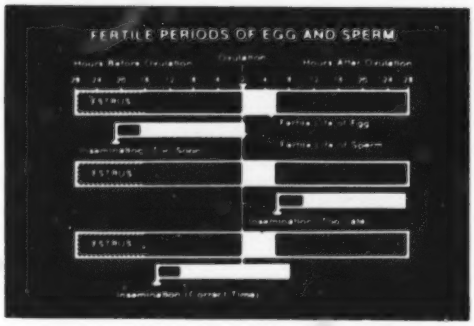


67. If insemination is late, the egg will have aged, deteriorated and died before the sperm are capable of fertilizing it.

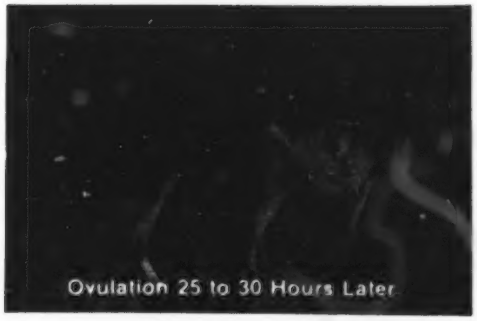
68. The fertile life of the sperm is only about 24 to 30 hours. If insemination is done too far ahead of ovulation, many sperm cells will have died. The possibility of conception is thus reduced.



69. To get good conception rates, a cow should be bred about 12 to 18 hours before the egg is released. This allows plenty of time for the sperm to first develop the capacity to fertilize the egg (a period of time called the **capacitation period**) and then continue to maintain fertilizing capacity until the egg is released.



70. For conception to occur, large numbers of fertile sperm should be in the upper part of the oviduct awaiting the arrival of a freshly ovulated egg. When insemination is either so early or so late that the egg and/or sperm present at the site of fertilization is already aged, poor conception results can be expected.



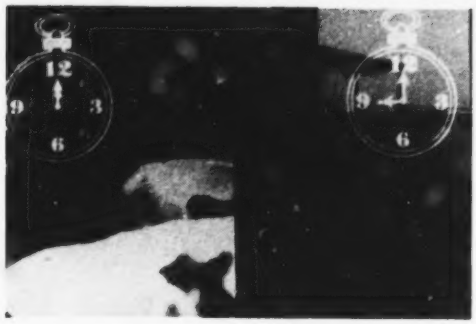
Use of Signs of Heat to Determine Insemination Timing

71. There are no outward signs to know exactly when ovulation occurs, but it is generally 25 to 30 hours after the first signs of heat. Cows are in heat when they stand to be mounted.

72. Heat signs are used to determine when to inseminate so that conception is most likely to occur.

Guideline: For best conception results, inseminate cows and heifers 12 hours after they are first observed standing to be mounted.

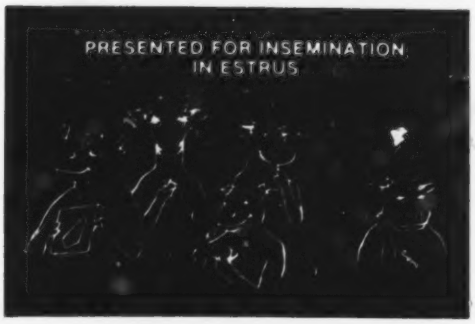
73. *Guideline:* Cows first observed in standing heat before 9 AM should be inseminated after 3 PM that same afternoon.



74. *Guideline:* Cows first observed standing to be mounted around noon should be inseminated the same day after 8 PM.

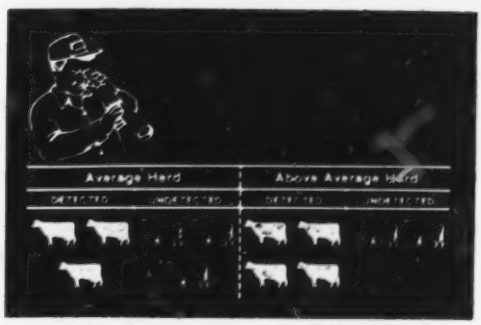
75. *Guideline:* Cows first observed standing to be mounted during the evening should be held over until the next morning for insemination, preferably before 10 AM.

HEAT DETECTION PRACTICES

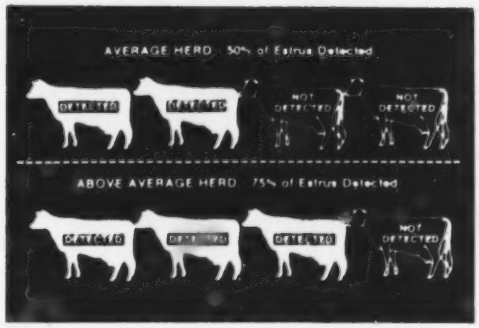


Results of Improving Heat Detection

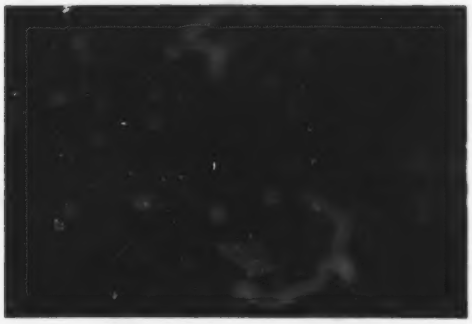
76. As many as one cow in every five now presented for insemination is not really in estrus



77. On the average, nearly half of all heat periods of cows go unobserved. Even in the better-managed herds only about two-thirds of the heats are observed.



78. Improving heat detection can have a very large effect on the dollars of income. Improving heat observation so that 75 out of every 100 heats are detected would be worth a considerable investment in detection procedures.



Selection and Responsibility of Personnel

79. A specific person(s) should be responsible for heat detection. This will help assure correct timing of insemination, which is necessary to maintain a 12- to 13-month calving interval.

80. A back-up person should also be designated for heat detection and should be made aware of heat detection responsibilities.

81. All persons having responsibility for heat detection should be instructed on the importance of this job — what to look for, when to look, and the benefits of a successful heat detection program.

Cow Identification Methods

82. All cows and heifers must be adequately identified for heat detection records. Ear tags, neck chains, branding and ankle bands are all commonly used.

83. It is important that the identification can be read at a distance. This involves such practices as using large tags, keeping hair in the ears trimmed, or, in the case of branding, doing a good job so that the brand is visible.

Interpreting Cows' Heat Signs

Standing Heat Sign

84. It is natural for cows that are not in heat, as well as those that are, to attempt to mount or ride others. Normally cows that are not in heat will not stand for others to mount them. The only sure sign that a cow is in heat is when she stands and lets other animals mount her.

Secondary Heat Signs

85. Cows also show secondary signs of heat. One advance sign that a cow may show as much as 48 hours before standing heat is attempting to mount other animals not in heat.

86. Another secondary sign of heat is a cow's laying her head up over the back of other animals. Also, a cow in heat shows a tendency to walk fences, bellow, and exhibit signs of nervousness.

87. Secondary heat signs include the lips of the vulva swelling and changing color from light pink to dark pink or red. The animal may also urinate more frequently than normal.

88. Since these secondary heat signs vary in length and degree of intensity, they are unreliable as keys to when the animal should be inseminated.

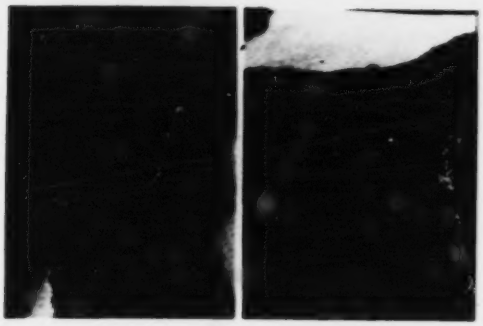
89. Secondary signs of heat may be an indication that the animal will soon display standing heat, is standing now, or has already gone out. These clues indicate at least that the specific cow must be watched more closely for standing heat.

Other Potential Heat Signs

90. A clue that the cow is moving into standing heat is the ruffled hair on her tailhead from other cows mounting her.

91. Other clues that the cow is standing for mounting are dirty flanks and saliva on her back from the mounting animals.

92. Cows may exhibit nervous behavior: — they may not come into the parlor in the usual order or let their milk down. These are further signs of heat. Animals in heat may have a drop off in milk production for one milking due to poor letdown.

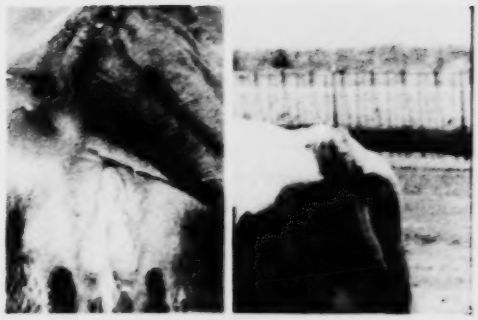


93. One final clue that an animal may be in heat is a clear discharge (similar in consistency to the white of an egg) stringing from her vulva or smeared on her side from switching her tail.

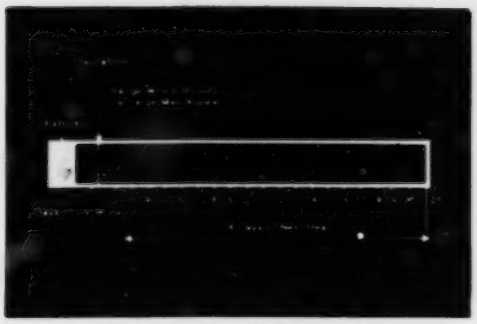
Going-out-of-Heat Signs

94. As an animal goes out of heat, she may stand to be ridden for a few seconds, but then scoots out from beneath the riding animal. Eventually she avoids all attempts made to mount her.

95. A cow may butt heads with other animals as she goes out of heat.

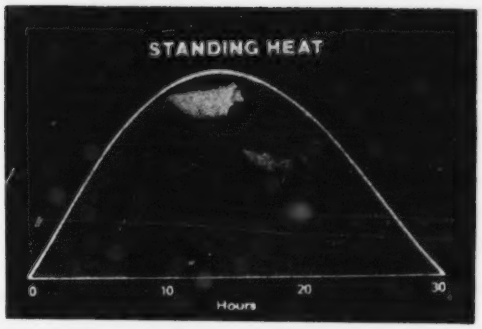


96. After going out of heat her vulva returns to a light pink color and becomes dry and wrinkled. Her tail head will show the signs of rubbing from the mountings.



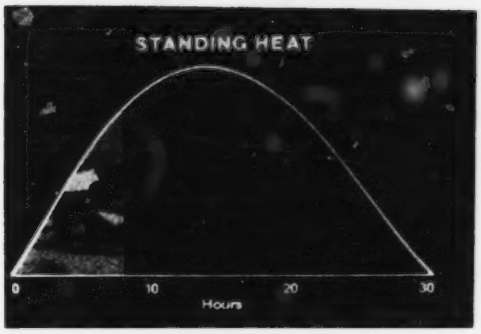
Post-Heat Sign

97. One to three days after an animal is in standing heat, a bloody discharge may come from her vulva. If the heat of the cow was not observed, the bloody discharge would indicate that she was recently in heat. However, by the time the discharge occurs, it is late to inseminate. A record should be made of when the discharge occurred and a note written to watch her closely 18 days later for the next standing heat.

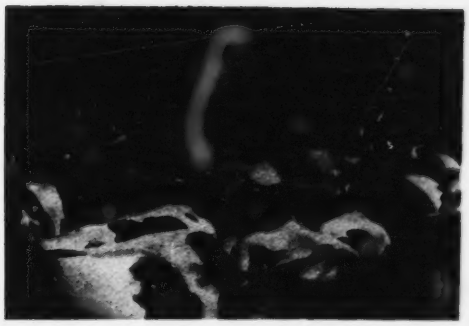


Variations in Length of Heat Period

98. One item to keep in mind when watching for animals in heat is that some cows are in heat much longer than others. Some cows stand for as little as 3 hours, others for as long as 30 hours.



99. While the average time in standing heat may be 14 hours, 25% of the cows stand to be ridden for less than 8 hours.



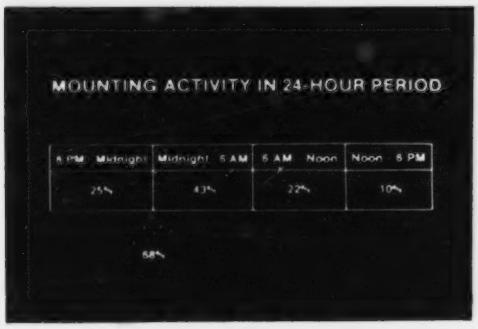
Management Considerations for Improving Heat Detection

Observation - A High Priority Item

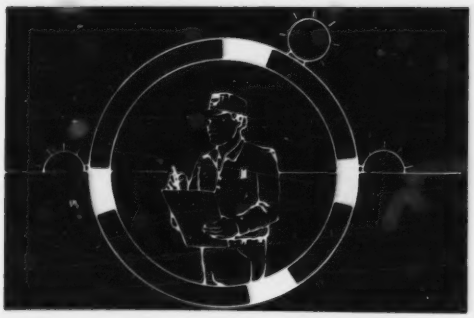
100. In order to catch a high percentage of standing heats, observation must be a high priority item. An observer must *observe* and do nothing else at the time.

Selecting Observation Time

101. The observer should *not* check heat while feeding, milking, or cleaning the barn. During these active times the cows are busy eating, being moved or distracted in some way from expressing signs of heat.



102. The majority of mounting activity occurs at less desirable or convenient observation times. In loose housing nearly 70% of the mounting activity occurs between 6 PM and 6 AM. In fact, the 6-hour period from midnight to 6 AM has by far the most mounting activity.



103. By scheduling three or four periods of adequate observation time each day, when the cows are most likely to express heat, most heat periods can be detected. The best times to watch for heat are first thing in the morning before the start of feeding or milking activities; early afternoon; and late in the evening after the animals are milked and have finished eating. These times are also the coolest times of the day when mounting is more frequent.

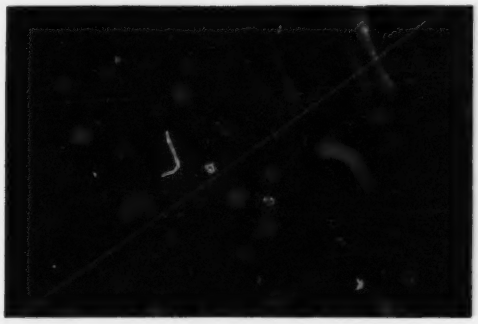
The Familiar Observer

104. Cows ought to be familiar with the person doing the checking. If possible they should not associate this person with feeding or trauma situations.

Size and Condition of Facilities

105. Adequate facilities for heat detection can be quite varied. But the area should be large enough for the animals to mingle freely and small enough so that all animals can be watched at once.

106. The area for observing heat should provide good footing so animals won't slip on rainy or icy days.



107. Slippery or muddy conditions may severely inhibit cows from mounting or standing for mounting. Cows need an area where they are free to interact, have good footing, and have a minimum of obstacles present.

The Problem of Sore Feet and Legs

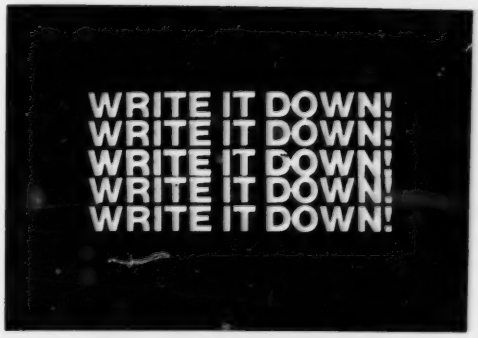
108. Cows with sore feet and legs make heat detection more confusing. These cows may not engage in mounting activity, or they may stand to be mounted when not in heat because of the pain involved in avoiding being mounted. Hoofs should be properly trimmed periodically. Infected feet should be treated promptly as soon as the problem is noticed.

Effect of Extreme Temperatures on Signs of Heat

109. Many variables influence standing heat, among them, disease, weather, and fear.

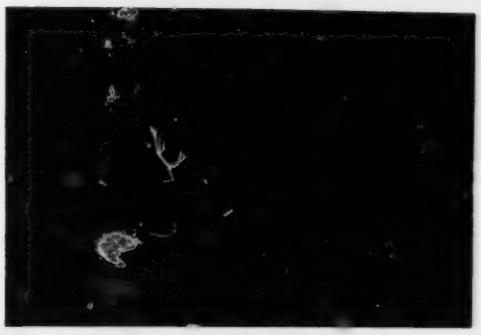
110. Cows tend to shows signs of heat for shorter periods on extremely warm humid days or extremely cold days.

111. A grove of trees or some sort of shade will keep mid-afternoon temperatures somewhat lower than those in direct sunlight. Cows express heat better under cooler conditions.

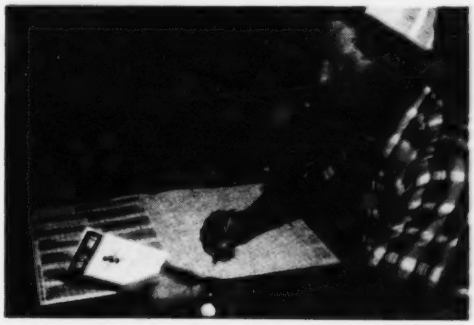


Keeping Records of Estrous Cycle Activity

112. Once the animals are detected in heat, the information should be written down promptly rather than trusting it to memory.

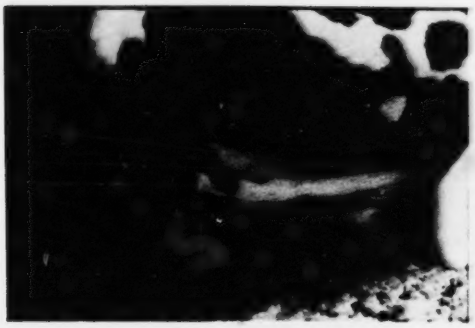


113. Keeping a handy pocket notebook to record a cow's name, number, and reproductive information is a small investment. All heat dates should be recorded for all cows regardless of whether or not they are inseminated.

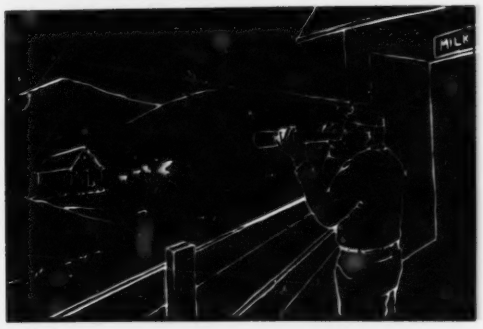


114. Information should be transferred each day to a centralized record which will help you watch for the same cow if she comes back in heat in 21 days.

115. Good records can help detect unusual cycle lengths. Problems needing veterinary treatment have a chance to be identified quickly and corrected before breeding.



116. Other observations such as an abnormal discharge or sore feet should also be written down.

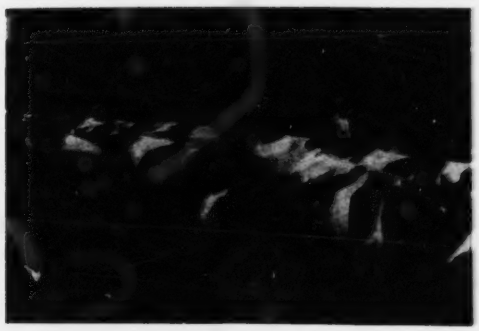


Use of Heat Detection Aids

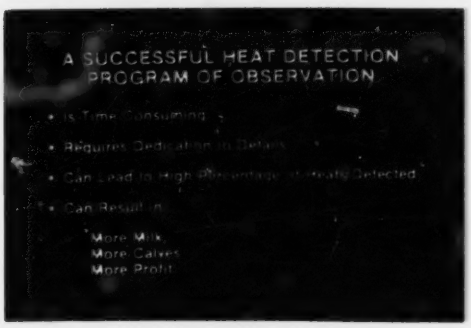
117. In some operations it is not easy or convenient to observe the animals for heat, such as when heifers are raised in a remote area of the farm.

118. Heat detection aids such as these patches can be applied to the rump of the animals. These patches are triggered to a red condition when the animal is mounted.

119. Care must be taken when using such aids since the patches can be activated by low branches or oilers.



120. Also, heat detection aids can become crutches in a herd with a poor heat detection program. Nothing can beat good observation.



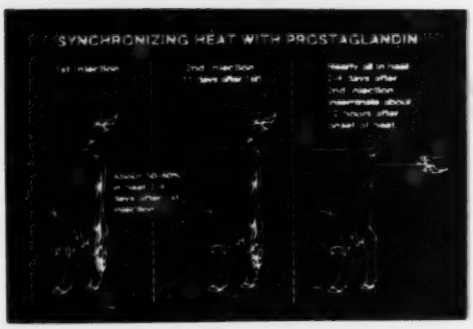
121. A successful program of heat detection using observation periods is time consuming and requires dedication to detail. But when followed, such a program can lead to a high percentage of heats detected. The results are more milk, more calves, and more profit!

Regulating the Time of Heat with Prostaglandin

122. Many farmers are unwilling or unable to take the time and effort to observe for animals in heat. A substance known as **prostaglandin**, when injected in cycling cows, can induce heat and allow insemination on schedule with less labor.

123. Conception rates from prostaglandin programs can be nearly as high as in good programs that use observation for heat. But in order to be effective, certain conditions must be met.

1. Cows must be cycling.
2. Cows must be on a good level of nutrition.
3. Heifers should be at least 13 to 15 months of age and should have reached at least 65% of mature body weight.



124. There are several programs for the use of prostaglandin. The producer can work with a veterinarian to establish the best program with a specific form of prostaglandin.

One program requires two injections 11 days apart. About 50 to 60% of the cows injected with prostaglandin can be expected to come into heat from 2 to 4 days after the first injection. All, or nearly all, can be expected to come into heat 2 to 4 days after the second injection (11 days after the first injection). Cows should be observed for heat and inseminated about 12 hours after heat begins.

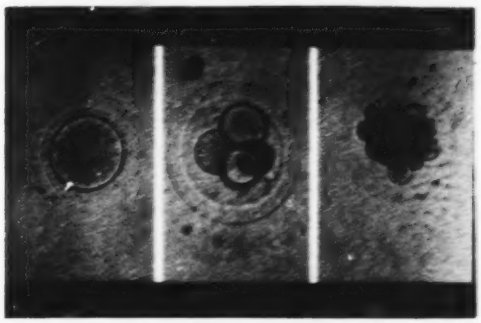
If any of the cows that come into heat following the first injection were bred at that time, they should not be given the second injection. A prostaglandin injection given to a pregnant animal will cause abortion.

125. All prostaglandin products are available only on a prescription legend basis through a veterinarian. Because of potential side effects, prostaglandin should not be handled by asthmatics or women who are (or might be) pregnant.

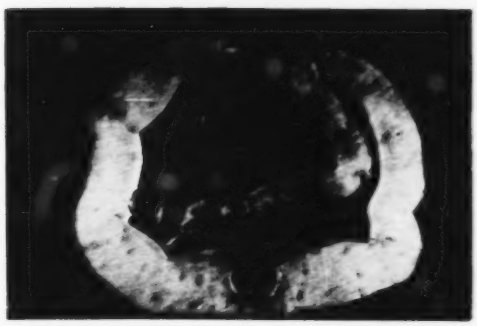
CONCEPTION AND GROWTH OF THE EMBRYO

Fertilization

126. At breeding, sperm are deposited in the vagina, cervix or uterus. **Fertilization** (union of sperm and egg) usually occurs in the upper third of the oviduct as the sperm which have traveled from the cervix area encounter the eggs traveling toward the uterus.



127. The fertilized egg begins cell division during its journey to the uterus. It takes about 4 days to travel the length of the oviduct. When the fertilized egg enters the uterus, it is in about the 12-cell stage.

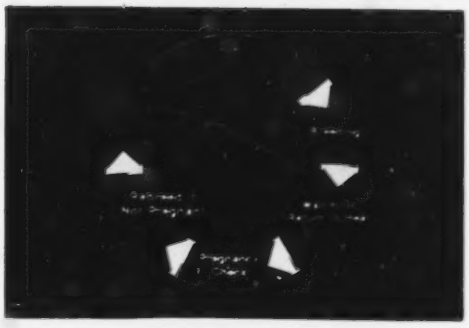


Embryo Development

128. Within the uterus the membranes of the embryo attach to the uterine wall.

129. Tissue develops from the embryo and surrounds it forming the **placenta**. The placenta has an inner membrane, the **amnion** (shown here), which is filled with fluid forming a cushion for the embryo.

130. The outer placental membranes, the **chorion**, form button-like structures called **cotyledons** that attach to button-like structures in the uterus called **caruncles**. Through these structures nourishment is transferred from the cow to the embryo.

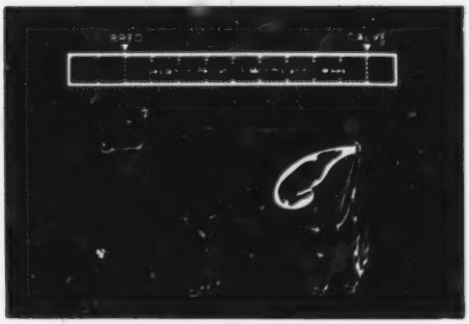


Pregnancy Check

131. All cows should be pregnancy-checked as soon as possible after breeding. If the animal is not pregnant, proper treatment, if necessary, can be started to improve the chance of pregnancy.

132. One method of checking pregnancy is rectal palpation. Depending upon the skill of the checker, this can be done 30 to 60 days after breeding.

133. Pregnancy can also be checked by measuring blood or milk progesterone levels 21 to 23 days after insemination. If the levels are low, the animal is not pregnant (95 to 100 percent accurate). If high, pregnancy of the animal is about 80 to 85% sure.



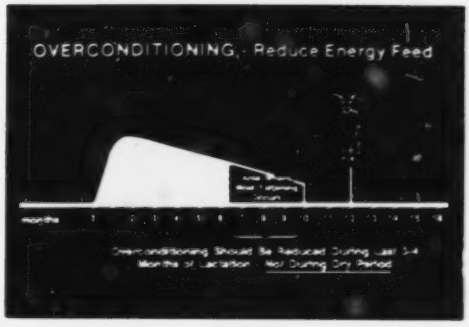
Length of Gestation Period

134. The normal gestation period for dairy cattle is 9 months and 1 week, or about 281 days with a range of 275 to 290 days. Each dairy breed has its characteristic average length of gestation.

NUTRITION AND REPRODUCTION

Energy

135. For good reproduction, cows should be neither too fat nor too thin. Thin cows have more breeding problems. Fat cows have more calving problems.

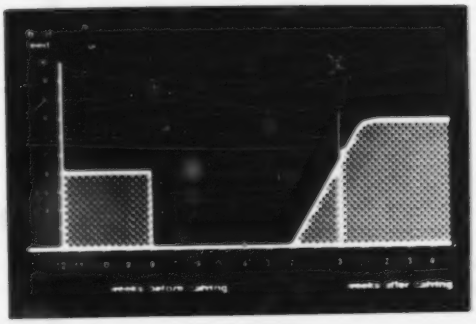


136. Preventing over-conditioning must start while cows are in milk. Most fattening occurs during the last 3 to 4 months of lactation, not in the dry period.

137. If cows consume too much grain, a founder-like condition called laminitis can develop. This causes rapid growth of the hoof. The condition is painful and may inhibit a cow's showing heat.

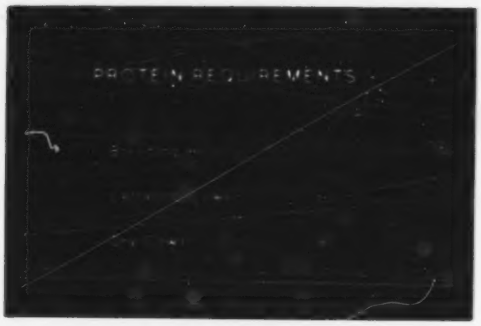
138. Dry cows need only about one-third as much energy as lactating cows do when producing 60 pounds of milk. An excess of ration energy during late lactation and during the dry period can lower fertility in the following lactation. Cows may suffer the "fat cow syndrome" and be more susceptible to ketosis, metritis, milk fever, and calving difficulties. These problems in turn increase the time necessary for the reproductive tract to regain a healthy tone after calving.

139. The extra effort of separating dry cows from the milking herd and feeding them correctly will pay off at calving time and during the following lactation.



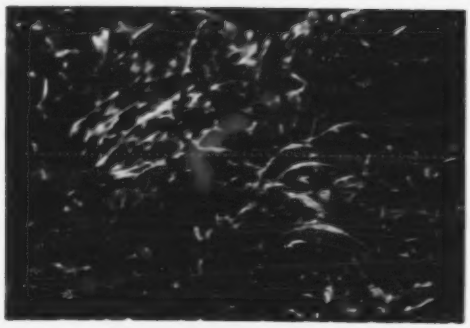
140. Two weeks before calving grain feeding should be slowly increased 1 or more pounds per day so that the cow is getting about 10 pounds of grain at calving.

141. Deficiency of energy (TDN) may affect reproduction more than any other nutritional problem. When dry cows are too thin, they generally produce less milk with a lower average milk fat test and have more fertility problems. The time to bring up condition is during lactation, not after they are dry.



Protein

142. Extreme deficiency of protein does reduce fertility, but the level of protein fed is rarely low enough to cause breeding problems. Diets containing these minimum levels of protein should be adequate for good reproduction, assuming the daily feed intake is adequate. There is a much lower protein requirement for dry cows than for cows in lactation.



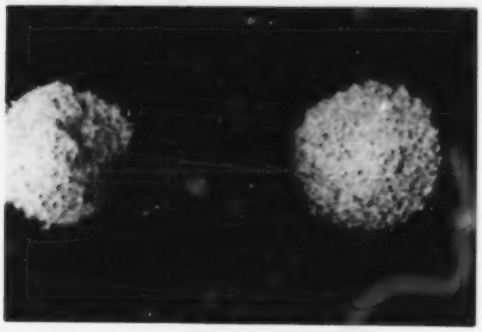
Minerals

Calcium and Phosphorus

143. A deficiency or imbalance of calcium and phosphorus has an indirect effect on dairy cattle fertility. Dry cows should not be fed large amounts of high-calcium forages such as pure alfalfa or clover hay. Grass hays or mostly grass hays are ideal.

144. Severe phosphorus deficiency can cause delayed puberty and increased time to first heat after calving. A moderate deficiency may result in 'silent' heats or repeat services.

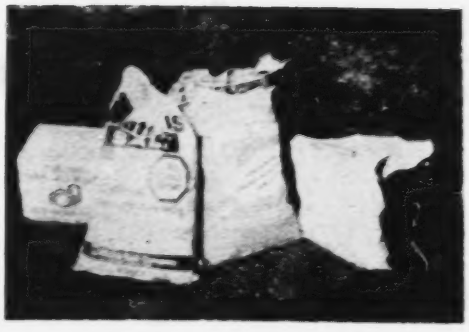
145. Forages should be tested periodically for phosphorus content and the rations supplemented as needed.



146. Concentrates such as wheat mids, distiller's grains, and soybean meal are good sources of phosphorus.

147. Additional sources of phosphorus are available in mineral form. These may be added as necessary to the grain mixture or fed free choice. It is important to select a mineral supplement which has a calcium-to-phosphorus ratio that balances the deficiencies in the forage program.

148. Mixing free-choice minerals with salt or using commercial mineral and salt mixtures forces the animal to get some mineral intake with the salt. But dairy cows should receive most, if not all, of their minerals in the grain or blended wth a complete ration.



Iodine

149. Inorganic iodine in iodized salt may be the only source of iodine needed in many herds.

ACTIVE DRUG INGREDIENTS

ytetracycline	500 grams per ton
ylenediamine Dihydriodide (EDDI)	0.037%

GUARANTEED ANALYSIS

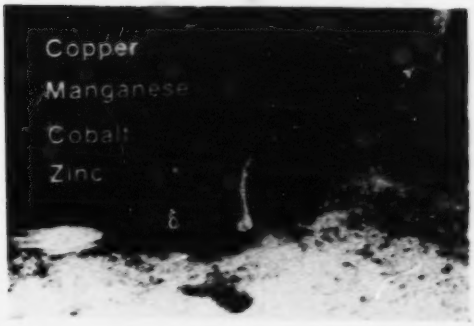
VITAMIN POTENCY (per pound)

amin A	333,333 USP Units
amin D-3	333,333 USP Units
amin E	150 Int. Units

MINERALS

cium (Ca) min	25.0%
cium (Ca) max	30.0%
sphorus (P) min	10.0%
gnesium (Mg)	0.5%

150. Too much iodine can cause health problems and excessive iodine levels in milk. When feeding more than one supplement that contains organic iodine (better known as EDDI), cows may get too much iodine, since most supplements have enough EDDI when used alone.



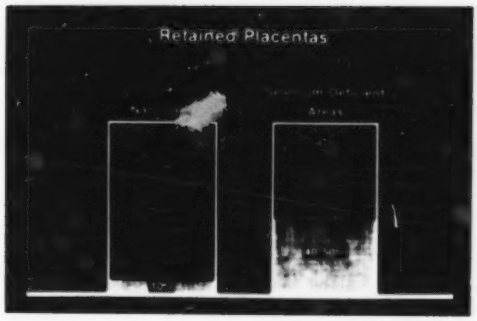
Other Trace Minerals

151. Other trace minerals necessary for reproduction include copper, manganese, cobalt, and zinc. Deficiency symptoms include retained placenta, delayed or silent heats, and deformed calves.

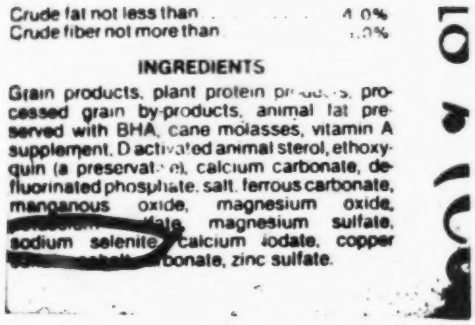
152. Forage testing helps to detect mineral deficiencies in home-grown forages. The most practical means to supplement trace minerals is with a well-fortified trace mineral salt included in the grain mix or fed free choice.

Selenium and Vitamin E - A Critical Relationship

153. Of all the trace minerals discovered to be essential, selenium has proved to be the most important for reproduction in animals. Retained placentas, uterine infection, and cystic ovarian disease are all reproductive diseases which are associated with selenium deficiency.



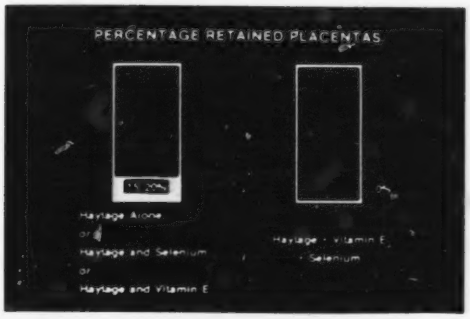
154. Nationally about 10% of the cows which calve each year have retained placentas. In geographic areas which are low in selenium, the incidence of retained placentas can be 2 to 5 times as high, or affecting 40 to 50% of cows calving. (Some problem herds in Ohio have demonstrated this high an incidence.) Nearly half of the cows with retained placentas require veterinary treatment for infection of the uterus associated with this problem.


Crude fat not less than 4.0%
Crude fiber not more than 1.0%

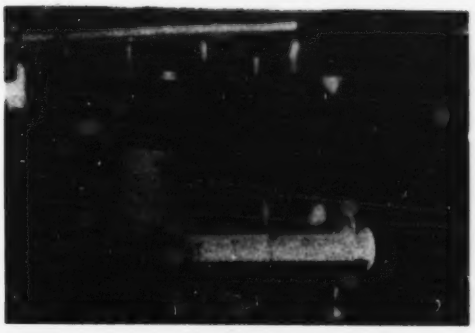
INGREDIENTS

Grain products, plant protein products, processed grain by-products, animal fat preserved with BHA, cane molasses, vitamin A supplement, D activated animal sterol, ethoxyquin (a preservative), calcium carbonate, defluorinated phosphate, salt, ferrous carbonate, manganous oxide, magnesium oxide, [redacted] magnesium sulfate, sodium selenite, calcium iodate, copper [redacted] carbonate, zinc sulfate.

155. Selenium is now added to many complete dairy feeds and supplements to supply one-tenth of a part per million (0.1 ppm) selenium in the total diet.



156. Oral vitamin E supplementation is necessary for efficient use of selenium for prevention of retained placentas (1.1 gram of vitamin E per day for 60 days before calving). In one experiment the incidence of retained placentas was 15 to 20% for each of these treatments: haylage alone, haylage and selenium injection, and haylage and vitamin E supplement. However, retained placentas were reduced to 0% when cows were fed vitamin E *and* injected with selenium.



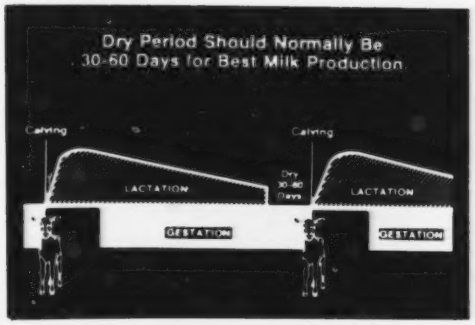
157. Dry cows can be injected with selenium when ration supplementation is not practical. But it must be remembered that selenium deficiency is not the only cause of retained placentas. It is important to see that other mineral levels are adequate and that unnecessary stresses during calving are avoided.

Vitamin A

158. Vitamins are essential for normal reproductive functions. The most important one is vitamin A.

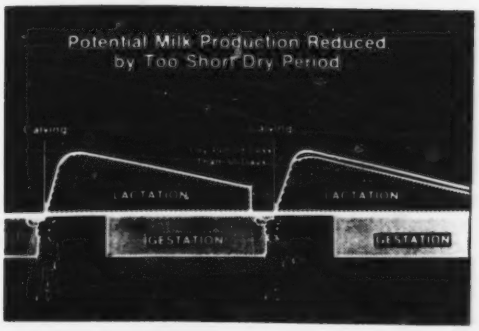
159. Vitamin A does not occur as such in feedstuffs but rather as carotene which is converted to vitamin A in the animal's body. Bleached-out, poor-quality hay or forages that have been stored for more than a year are poor sources of carotene. Vitamin A supplementation is especially important when feeding heat-damaged forages which have lost their carotene.

DRY COWS

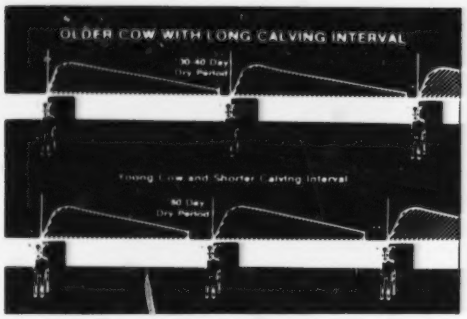


Length of Dry Period Affects Milk Production

160. Cows need a rest before they calve and start new lactation. This dry period should normally be between 30 and 60 days.



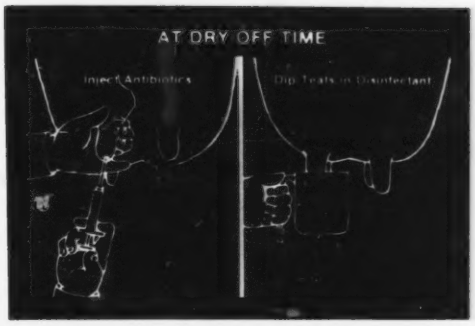
161. If the dry period is too short (less than 30 days), a cow will milk below her potential the next lactation.



162. The age of the cow and the length of the calving interval determine the best length of the dry period.

Drying-off Procedures

163. The best **drying-off** procedure is to discontinue milking abruptly.



164. A very critical time for control of new mastitis infections is during the first week after dry-off. Antibiotics should be injected into the mammary gland at dry-off time and the teats dipped in disinfectant solution.

CALVING AND CARE OF THE NEWBORN

Preparation for and Signs of Calving

165.
1. Separate from the other cows the "about-to-calve-in-the-next-7-to-10-days" group.
2. Switch this group gradually to the forage and grain they will be fed as they enter the milking herd.
3. Clip each cow's udder, flank and tail.
4. Wash the udder, sanitize, dry with single-service paper towels, and dip teats each day.
5. Prepare clean, dry, comfortable maternity stalls or have clean pasture available.

166. 6. Milk out cow before calving only if she is obviously stressed; save colostrum by freezing it.
7. If edema is a problem, use a diuretic to remove excess water; but observe withdrawal times before use of milk.
8. Watch (especially when cow freshens sooner than expected) that enough time has elapsed for any dry-cow treatment with antibiotics to meet withdrawal restrictions.

167. Signs of approaching calving:

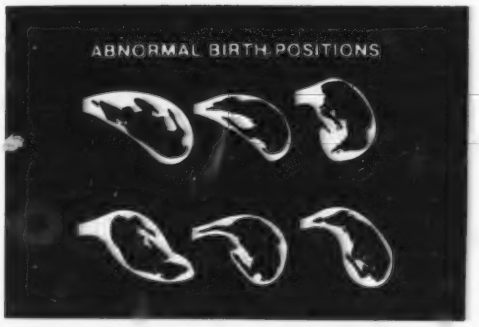
1. Good records
2. Relaxation of ligaments around genitalia
3. Swelling of vulva
4. Swelling of udder
5. Dripping of colostrum from teats
6. Liquid cervical seal extruding from vulva
7. Cows becoming restless and leaving herd

Position of Calf and Labor

168. The normal position for a calf to be born is with front feet first with nose between the legs, dorsal (top) side up, and rear legs extended back.

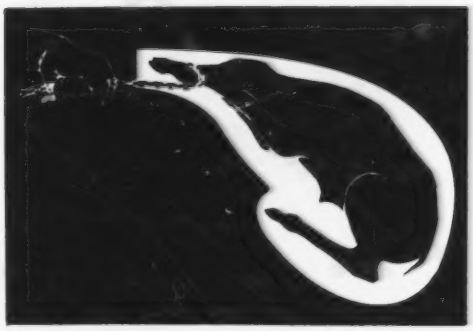
169. There are two main stages to labor. The first, the cervical dilation period, normally lasts 2 to 6 hours. The cow will be somewhat uneasy during this stage.

170. The second stage of labor starts when the head or feet of the calf enter the vagina. This stimulates abdominal straining to expel the calf. Actual delivery of the calf should require only one-half to two hours of this straining. Most deliveries are normal and require no assistance.



Calving Assistance

171. If calving is long and difficult, assistance may be required. Sometimes the calf is in one of several abnormal birth positions. It will need to be turned into a position so that the birth process can proceed.



172. The cause of most difficult births is a calf that is too large for the pelvic opening. This problem calls for pulling on the calf to assist the cow in getting it through the birth canal and expelled.

173. An examination to consider the need for calving assistance should be done when:

1. The cow has been in the first stage of labor for three to six hours and has not started actively straining.
2. The cow has been in the second stage of labor for one to two hours with little progress.
3. The water sac or membranes have been evident for one to two hours with little progress.

174. If the cow fails to "clean" (expel the placenta) within a normal time (2 to 8 hours), the "retained placenta" condition (mentioned earlier) may exist. After 8 hours of failing to clean, veterinarian assistance should be obtained and the treatment recommended begun within 24 to 48 hours. No attempts to force removal of the placenta manually should be made.

175. Difficult calving results in higher calf losses and more reproduction and milking problems in cows.

Up to 18% of first-calf heifers need considerable assistance, compared to 3 to 8% for second and later calvings.

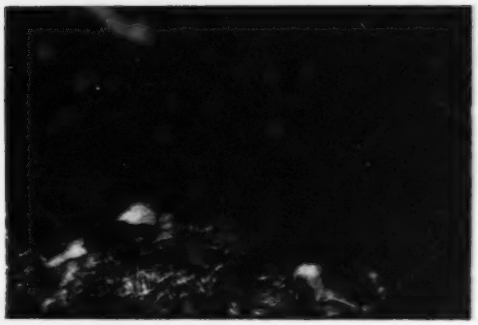
Heifers that are too small have twice as many difficulties as do full-grown heifers.

The use of AI bulls rated good for calving ease can decrease the number of difficult births.

Care of Newborn Calves

176. One out of every five heifer calves never reaches 6 months of age, and most of the losses are within the first month. The extra effort required to save heifer calves during the first month of their lives can make a big difference in dairy returns over time.

177. As soon as the calf is born, it is important to see that the respiratory tract is clear and that the calf gets air into its lungs and is breathing normally.

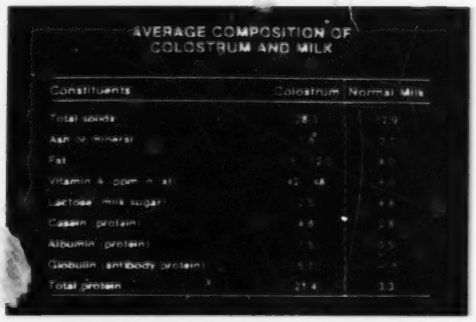


178. If necessary, stimulate the calf to breathe by either:

1. Rubbing it briskly.
2. Tickling the inside of the nostril with a straw.
3. Slapping it with the flat of the hand.
4. Suspending it briefly by its rear legs to drain fluid from the lungs and throat.

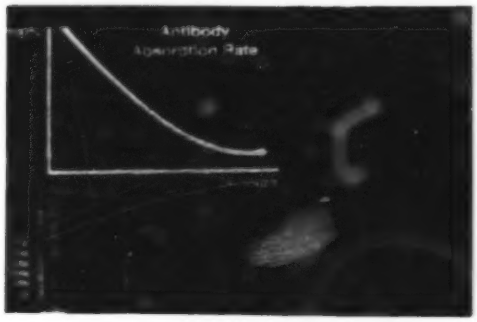
179. Calves are subject to bacterial infections in the navel until this area is completely healed. Immersing the navel stump in tincture of iodine immediately after birth can greatly reduce navel infection.

180. The calf should be given some type of identification before any possibility of mistaken identity can develop.

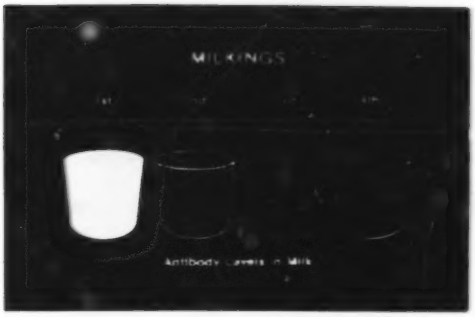


Importance of Colostrum to Newborn Calf

181. The first milk from a cow after calving is known as **colostrum**. It is very different from lactation milk. Colostrum has the antibodies and extra protein and minerals needed by the new calf.

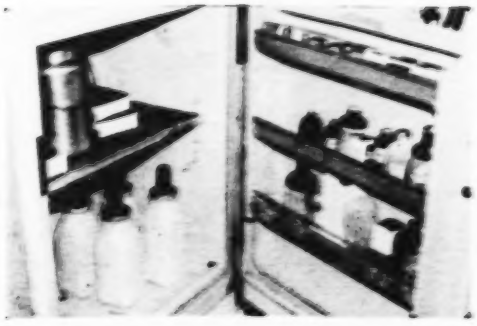


182. The ability of the calf to absorb these antibodies through its intestines decreases to zero during the first 24 hours. So the calf must get colostrum *soon after birth* — preferably within 2 hours and ideally within 10 minutes.



183. It is also important that the calf get colostrum from the *first milking* after calving. The amount of antibodies in the colostrum that give the calf disease protection drops rapidly in the second, third, and fourth milkings.

184. And it is important to assure that the calf gets adequate amounts of colostrum during the first 12 hours, even if this means feeding the calf by hand. When calves received only 2 to 4 pounds of colostrum in the first 12 hours, nearly 2½ times as many of them died as those that got 8 to 10 pounds of colostrum.



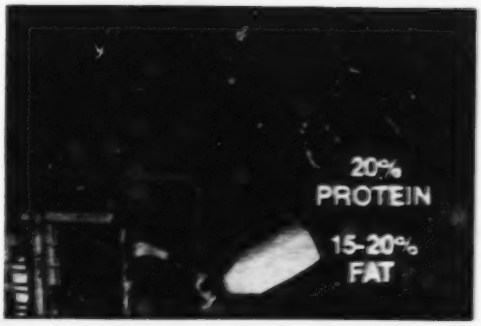
185. It is a good practice to keep a few quarts of colostrum in the freezer. This may save a calf's life when its mother, for one reason or another, is unable to provide colostrum.

186. There may be no advantage to leaving the calf with the cow for more than several hours. Dairy producers leaving the cow and calf together for longer times may be relying too much on the mothering ability of the cow, to the neglect of personal observation of the calf. Personal attention can be very important to assure that the calf gets the first milk of the cow, gets it very soon, and gets adequate amounts.

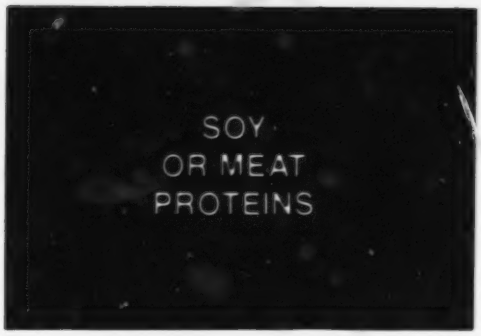
The Next Step in Nutrition - Milk or Milk Replacers

187. Within the first week of life, calves can be switched to whole milk, sour colostrum, or a good commercial milk replacer. The choice depends largely upon the costs and convenience of handling.

188. Whatever the choice, buckets and other feeding utensils must be kept sanitary. If this is done conscientiously, many calves can be saved from disease and death.

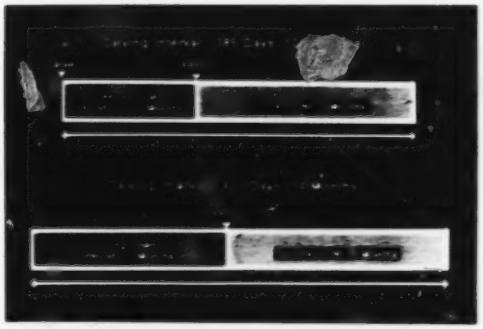


189. Better milk replacers are made from some form of dried milk powder and contain about 20% protein and 15 to 20% fat. The 20% fat provides the needed energy and possibly reduces scouring. Greater calf losses occur when the replacer contains only 10% fat.



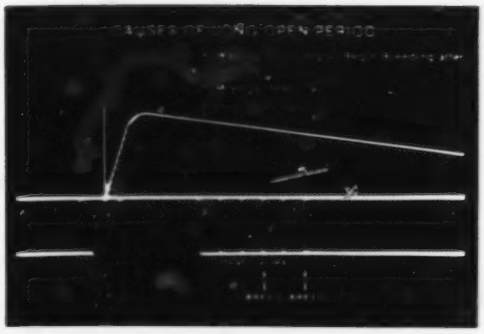
190. Avoid inferior milk replacers made from soy or meat proteins. These products cannot be digested properly by the calf. Also they often do not have the necessary fat percentage to give the calf the energy it needs.

TIMING OF REBREEDING



Costly Results of Failure to Rebreed Soon

191. Time of breeding the heifer or cow after calving is important in order to get the best conception and calving intervals. Average calving intervals in the U.S. are 13 to 13½ months. This interval is too high for maximum production of milk in calves. Holding the "open" period (the time from calving until the cow is rebred) to 3½ months would give a 12½-month calving interval. This shorter open period would produce more milk per cow per day in the herd and more calves in a lifetime.



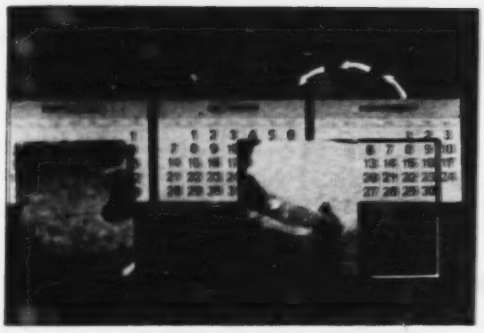
192. Major causes of a cow being open too many days are:

1. Waiting too long to begin breeding after calving
2. Missing heats
3. Poor conception

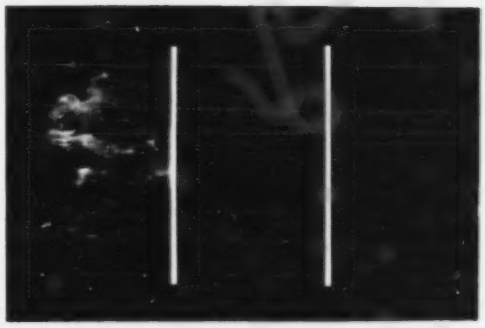
Reaching for the Goal of 12- to 12½-month Calving Intervals

193. In order to achieve maximum milk production, dairy producers should strive for an average calving interval of 12 months. This requires that cows be bred by about 90 days after calving, as a herd average.

194. Many demands on the time and management skills of the dairy producer, as well as many stresses on heavy milking cows, make it very difficult to maintain a 12-month calving interval.



195. One solution to maintaining shorter calving intervals is to inseminate some cows at the first heat which occurs 45 days after calving.

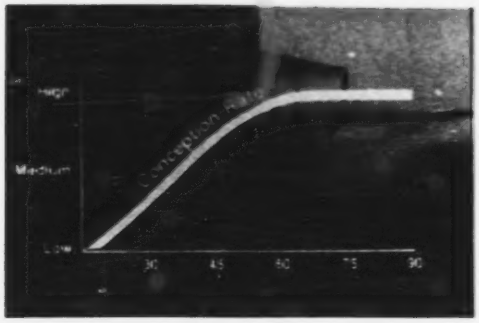


Length of the Cow's Recovery Period and Early Rebreeding

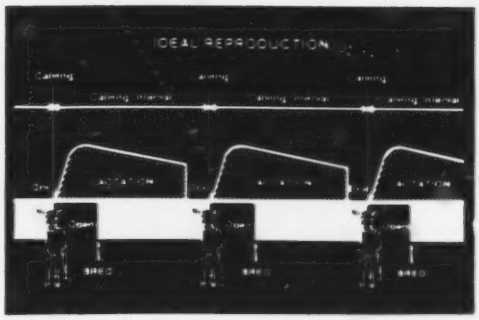
196. However, not all cows will be ready to breed back at this time. After calving, the reproductive tract must return to a normal size and be healed and clear of infection before a new pregnancy can exist. Normally this takes 30 to 40 days.

197. In cows having calving problems or twins, this recovery period can be longer. A cow with severe infection or retained placenta may take 100 days or longer to return to normal.

198. Using a qualified veterinarian to examine the cows about 30 days after calving is recommended. The veterinarian can determine whether there are problems and, when necessary, recommend corrections for early rebreeding.



199. A lower overall conception rate can be expected from inseminating cows at 45 days after calving rather than waiting until 60 days. But this practice can increase milk and calf production over the cow's lifetime.



Summary

200. Adequate levels of nutrition and very close attention to the animals' health, along with use of the best reproductive practices, are essential in achieving the ideal of 12- to 12½-month calving intervals.